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A New Model of The Student Attendance Monitoring System Using RFID Technology

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Abstract. The development of information technology today has been widely used to provide convenience, speed up, and streamline work. Presence system that is still applied is the type of precession using manual presence using paper media and is inefficient when viewed in terms of time, a recapitulation of data on the existence and accuracy or authenticity of the data presented. There is still often the habit of leaving a signature as proof of an employee's presence. This study aims to provide a new model for conducting of presence, a presence system that uses RFID technology. RFID will utilize sensors to read data. The use of RFID is to facilitate lecturers and students in monitoring class attendance. On the RFID card, there is a radio frequency mounted affixed to the reading machine; the system will automatically send student data into the database. Thus, students can do it quickly, and data can also be agreed promptly and adequately. In addition, students and lecturers are also motivated to arrive early because the system can store and display data directly.

1. Introduction

Today, the rapid development of technology is used to facilitate work. Work that is usually done by humans can be carried out by a system automatically, for example, is an automatic attendance system at a college or school. In this system, the attendance process is not done manually or with a signature by students, but instead uses identification technology [1]. RFID technology is one example of identification technology. This technology consists of a reader (reader) and tags that can be either barcode or smartcard. RFID technology is superior to other identification technologies, because in reading or rewriting data on the RFID tag it does not require direct contact between the RFID tag and the reader, has the ability to send clean and reliable data needed as input for software on the attendance system, data can be read accurately in the reading range, and the design costs are low.

Technology is currently needed by the campus, technology involvement is to reduce manual human activity in every activity on the campus. One of the activities on campus that needs to be involved with technology is teacher and student attendance activities. Radio Frequency Identification (RFID) technology is one technology that is able to identify certain objects. With these capabilities, RFID



technology is a technology candidate that can be implemented on campus to support lecture attendance in classrooms and laboratories. At this time, the attendance system that is on campus is still done manually. Before starting the teaching-learning process, the lecturer enters the classroom or laboratory to teach students who are already in the class. Then during the teaching-learning activities, the lecturer gives attendance of students in the form of documents that will be signed by all students in the room. Data obtained from the attendance paper will be recapitulated in the academic administration section.

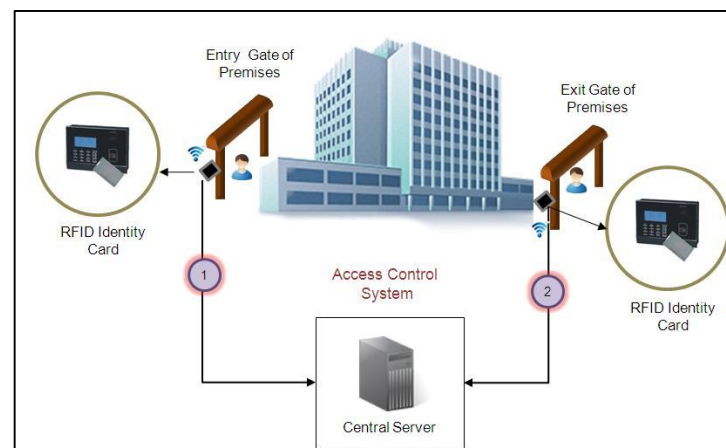


Figure 1. RFID attendance system

At this time, several campuses are already automating their systems by utilizing fingerprint technology for attendance. But with fingerprint technology, the absent system is done one by one by the user. Using the fingerprint method will cause a queue if it handles enough users in close proximity and causes a lack of time efficiency [2]. Another technology used for attendance systems is barcode which has a unique code for each card, but the card detection is also done with a longer delay time because the barcode reader must be in the same direction with the barcode card. This will also cause queues and lack of time efficiency. For this reason, the model that will be developed in this study is to model an automatic attendance system using RFID to simplify and speed up attendance activities during lectures. This research will produce an automated attendance prototype system. Automation in question is the collection of student absentee data in a study room and in certain subjects into a centralized database.

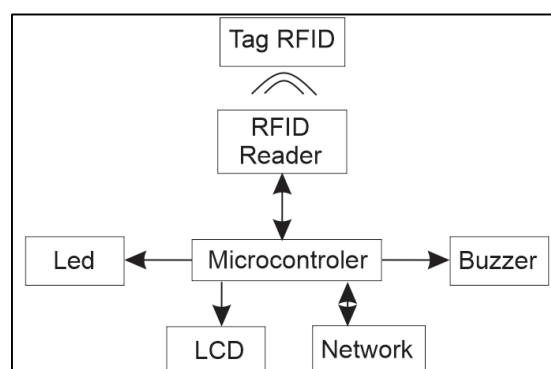


Figure 2. Block diagram of the whole system

The function of each block in the block diagram above is as follows:

- Block reader; the input block consists of an RFID reader, the tag data card that the reader detects will be sent to the microcontroller
- Block microcontroller, data processor and central controller of the system

- The indicator block, consisting of LCD, LED, and buzzer.
- Block Ethernet module, communication agreement using internet protocol.

2. Literature Review

2.1. RFID (Radio Frequency Identification)

RFID stands for Radio Frequency Identification, which is information that is carried through radio waves. An RFID system always consists of two components, namely:

- Transponder/ marker, (transponder = transmitter + responder), which is a tag/marker for the identifier in the RFID system that is on the object to be identified,
- reader, a device for reading or capturing information signals from stamps. This tool can operate in reading or write mode depending on the technology used.

A reader has a radio frequency module (transmitter and receiver), a control unit, and a coupling element on the transponder. Many readers are given additional interfaces (RS 232, RS 485, etc.) to be able to forward the data received to other systems such as PCs, robot control systems, and others [3]

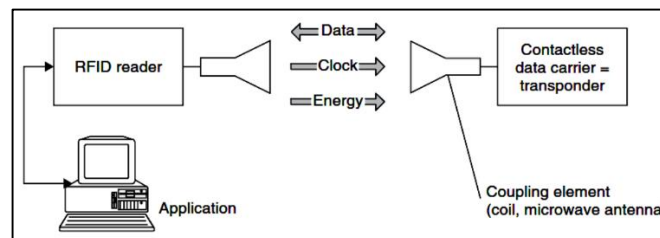


Figure 3. Reader dan transponder komponen utama RFID

RFID is used as a basis for attendance control systems. The system is composed of Personal Computers in each lecture hall, each PC connected to one network. Every lecture room has an RFID reader and a web-camera connected to a PC. The camera is used to take pictures of students. When a student enters the room, the RFID reader automatically reads his ID while the web-camera simultaneously takes a picture of the student who registers and sends data to a PC [2] The following chapter describes Automatic Identification and Data Capture (AIDC) technology. A brief overview of AIDC technology that is used in library management and attendance systems [4].

2.2. Tag and Reader RFID

RFID (Radio Frequency Identification) technology is one of several Auto-ID (Automatic Identification) technologies. The auto-ID allows for automatic identification, such as barcode systems, optical characters, MM biometrics, smart cards, voice identification, finger point procedures, and NFC (Near-Field Communication) [5]. RFID was first implemented by the British in 1940 during the Second World War. Applied as a friend or foe identification system "Identification Friend or Foe" IFF system, by installing transponders on fighter planes and tanks [6].

RFID is an exceptional standard that states a network uses radio signals to communicate with a label that is placed on an object such as humans, animals, products. RFID is a wireless technology that is used to identify an object through radio waves. RFID makes it possible to store and receive data remotely. Using a means of RFID labels or transponder tags and readers that function as readers of data stored on the tag, without having to contact directly with the tag or wirelessly [7].

- RFID Tag: A tag, also called a transponder, consists of an antenna that supports the decoder and encoder process and a memory chip that serves as a storage place for a serial number and other information that represents the desired data [8]. The tag is placed on the object identified and stores specific data about the item.

- **RFID Reader:** RFID reader is a scanning device to read the information contained in a tag, and communicate the data to a database. The reader is the link between the application software and the antenna that radiates radio waves to the RFID tag to read the id number and other information stored in the card. A reader must be compatible with the cards used so that RFID tags can be read [9].

Table 1 reveals the frequency range for the different types of frequencies along with the distance that they can travel, regulations, and data speed. For example, Low frequency usually ranges from 120-150 KHz which is unregulated type of frequency having a range of 10 cm. The data speed for such type of frequencies is usually low.

Table 1. Frequency Type and Specifications

Frequency Type	Range of Frequency	Regulations	Range	Data Speed	Cost of the Tags
Low frequency	120-150 KHz	Unregulated	10 cm	Low	\$1
High frequency	3-30 MHz	ISM band worldwide	10 cm - 1 m	Moderate	\$3-\$5
Ultra-high frequency	300 MHz – GHz	Short range devices	1 m – 100 m	Moderate to high	\$5 - \$10

According to P. Grover and A. Ahuja [11], RFID in libraries was initially designed and proposed to the world in the late 1990s. RFID technology took care of the overall workflow by making the check-in/check-out automatic thus limiting the hard work for the users and workers. Singapore was the primary nation to present RFID in libraries, and the Rockefeller University in New York was the main scholastic library in the United States to make utilization of this innovation. Farmington Community Library was the first open organization to utilize the RFID innovation. Both Rockefeller University and Farmington began utilizing RFID in 1999. In Europe, the primary open library to utilize RFID was Netherland's the Hoogezand-Sappemeer in 2001, where borrowers were given choices. The survey suggested that 70% of individuals adjusted to the RFID technology rapidly. The survey indicated that RFID is predominantly used in the United States compared to the United Kingdom and Japan.

3. Methodology

- The research methodology used is as follows.
- Researching and analyzing research that has been done previously related to the system.
- Conduct a study of the order using the following methods.
 - Literature study, namely by studying articles, journals, books, and papers related to the system.
 - Consultation with supervisors regarding the order.
- Creating a system design according to the objectives and theoretical basis.
- Experiment to get the desired results by the program design.
- Perform system testing and analysis in the research object

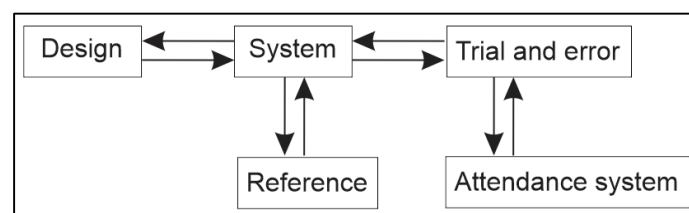


Figure 4. Research Work Procedure Block Diagram

4. Proposed System Implementation

In this RFID system, there are Personal Computers in each lecture hall, each PC connected to one network. When a student enters the room, the RFID reader automatically reads his ID and sends data to the PC. This ID is sent to the PC where the system will compare the information with information in the database by the ID specified. Then the system uploads the statistical results of the present ID to the database server via the internet network that has been provided. Database on the server will have data of students who are current or not present in a particular lecture, as well as student attendance time. Lecturers can download data in the database for attendance assessment.

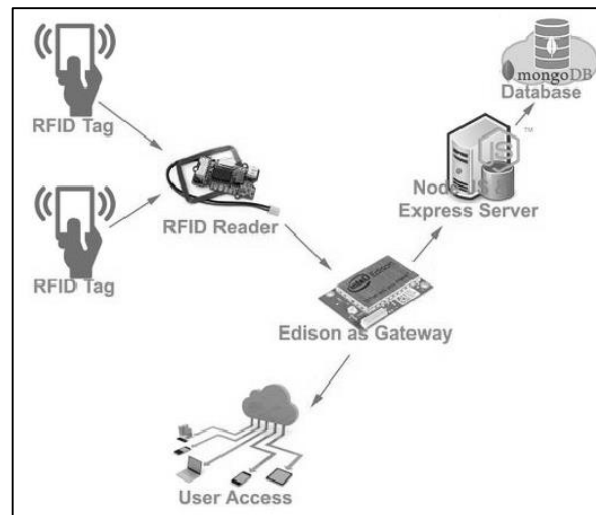


Figure 5. System Implementation

5. Results

The system work process starts by initializing the input and output ports. When the card is scanned into the incoming RFID, the RFID will check whether the data matches the database in the PC, if appropriate then Arduino gives a command to the DC motor to open the door and the PC will record the clock and activate the infrared sensor as a marker if the object has entered the room. After the object enters the room, the door will close. Then if the data that the scanned RFID scans do not match later, the outgoing RFID will be active and check whether the data in the database on the PC is compatible, if appropriate then Arduino will order the DC motor to open the door, and the PC records the exit time and saves the calculation on the PC and activates infrared sensor, when the object has left the door will close. If it is not suitable for three attempts, the alarm will sound.

From these results, there are several recommendations in this study, including:

- To increase the efficiency and effectiveness of data stored in a database on a server computer, need a fast and stable internet connection.
- The development of attendance systems using RFID technology is further recommended by increasing security to avoid students who are still committing fraud in terms of entrusting RFID cards for attendance.

The attendance system has been implemented in hardware and has been widely tested. The operation of the system starts when the microcontroller sends a trigger signal to the RFID reader, which starts operating and interacts with the tag. The demonstration for the RFID-based attendance system was carried out using two users as students one and student two. The proposed system conducted an operation marking the presence of students with their ID cards, which are passive RFID tags. The accuracy of detecting these passive RFID tags is high when the tags are near the RFID reader (a distance of about 2 cm). When the gap between the RFID reader and the passive RFID tag increases, the RFID reader stops detecting the RFID passive tag. The test results show the accuracy and efficiency of the system for distances ranging between 1 and 3 cm.

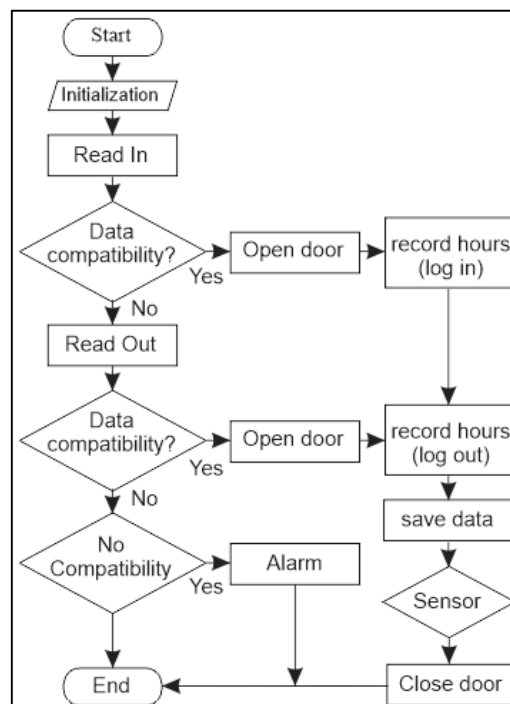


Figure 6. Flowchart system model

6. Conclusion and Future Scope

Based on the research conducted by the author through the needs planning stage, the process of modeling and implementation, the conclusions can be obtained as follows:

By using the student attendance system using RFID technology, it is beneficial for lecturers in terms of lectures. Moreover, the data of absent students is directly stored into a database on the server computer. With the student attendance system using RFID technology, the management of the inputted data, and the archive of reports that often occur file loss no longer occurs because it has been stored in a database. With the student attendance system using RFID technology, it can accelerate the attendance process of students who previously still had to fill the attendance form with a signature

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